

## REMARKS

Claims 21-23, 25, and 34-41 are pending and rejected in the present application. Claims 21 and 40 are amended, and claim 38 is canceled, hereby.

Responsive to the objection to the drawings under 37 C.F.R. §1.83(a), Applicants have amended claims 21 and 40, and canceled claim 38, in order to  
5 remove therefrom any features not shown in the drawings. Applicants submit that the drawings are now in conformance with 37 C.F.R. §1.83(a).

Responsive to the objection of claim 21 on the basis of an informality, Applicants have amended claim 21 keeping in mind the comments offered by the Examiner, for which courtesy the Examiner is thanked.

10 Responsive to the rejection of claims 21-23, 25, 34-39 and 41 under 35 U.S.C. §112, second paragraph, Applicant respectfully traverses. More particularly, the Examiner rejected claims 21 and 41 on the basis that the term “substantially coplanar” recited therein is a relative term that renders the claim indefinite. Applicants submit that the term “substantially coplanar” does not  
15 render the claim indefinite.

The fact that claim language, including terms of degree, may not be precise, does not automatically render the claim indefinite under 35 U.S.C. 112, second paragraph. Acceptability of the claim language depends on whether one of ordinary skill in the art would understand what is claimed, in light of the  
20 specification. See *Seattle Box Co., v. Industrial Crating & Packing, Inc.*, 731 F.2d

818, 221 USPQ 568 (*Fed. Cir. 1984*). When a relative term is present in a claim, first a determination is to be made as to whether the specification provides some standard for measuring that degree. If it does not, a determination is made as to whether one of ordinary skill in the art, in view of the prior art and the status of the art, would be nevertheless reasonably apprised of the scope of the invention.  
5 See *In re Wiggins*, 488 F. 2d 538, 541, 179 USPQ 421, 423 (CCPA 1973).

Applicants submit that the present Specification sufficiently defines the requisite degree of coplanarity required by the term "substantially coplanar" recited in claims 21 and 41, and that therefore those claims are not rendered  
10 indefinite by the inclusion of that term therein.

At page 5, lines 24-27 (as amended) the present Specification recites "as shown in FIG. 2B, N+ source regions 206 are formed in layer 202 by ion implantation and diffusion to a selected depth 216 that is approximately coplanar with selected level 211 of gate material 210 and thereby provides overlap  
15 between gate material 210 and source regions 206". Applicants submit that the foregoing quoted portion of the present Specification makes clear that the source regions 206 are formed by implantation and diffusion to a depth that is (within the generally-accepted process limits and capabilities of those processes) approximately or substantially coplanar with conductive gate material 210.

20 Applicants submit that the above-quoted portion of the present Specification provides a standard for determining the degree of coplanarity

required by the terms "approximately coplanar" and/or "substantially coplanar" as recited in claims 21 and 41, Applicants submit that the claims are not rendered indefinite by the inclusion of that term therein. Accordingly, Applicants submit that claims 21-23, 25, 34-39 and 41 are in their present form in allowable form.

5 Further, Applicants submit that one of ordinary skill in the art would, in view of the status of the art, be reasonably apprised of the scope of the term "substantially coplanar" as recited in claims 21 and 41, and that therefore claims 21 and 41 are not rendered indefinite by the inclusion of that term therein.

The above-quoted portion of the present Specification teaches that source  
10 regions are formed by ion implantation and diffusion. Applicants submit that one of ordinary skill in the art has a reasonable familiarity with the processes of ion implantation and diffusion, and the process capability and tolerances of those processes, and would therefore understand the scope of term "substantially coplanar" in connection with structures formed by those processes.

15 Since one of reasonable skill in the art would be reasonably of the scope of the term "substantially coplanar" as recited in claims 21 and 41, Applicants submit that the claims are not rendered indefinite by the inclusion therein of that term. Accordingly, Applicants request withdrawal of the rejection and submit that claims 21-23, 25, 34-39 and 41 are in allowable form.

20 Moreover, the term "substantially" has specifically been upheld as not rendering a claim indefinite when used in conjunction with another term to

describe a particular characteristic of a claimed invention. The claim limitation "to substantially increase the efficiency of the compound as a copper extractant" was held to be definite in view of the general guidelines contained in the specification.

*See In re Mattison, 509 F.2d 563, 184 USPQ 484 (CCPA 1975) (Emphasis*

5 *Added)*. Similarly, the claim limitation "which produces substantially equal E and H plane illumination patterns" was deemed to be definite because one of ordinary skill in the art would know what was meant by the term "substantially equal." See *Andrew Corp. v. Gabriel Electronics, 847 F.2d 819, 6 USPQ2d 2010 (Fed. Cir. 1988) (Emphasis Added)*.

10 In summary, Applicants submit that the present Specification provides a sufficient general guideline for determining the scope of the term "substantially coplanar" and that one skilled in the art would know what was meant by that term. Therefore, Applicants submit that claims 21 and 41 are not rendered indefinite by the inclusion therein of the term "substantially coplanar".

15 Accordingly, Applicants submit that claims 21-23, 25, 34-39 and 41 are in allowable form, and respectfully request withdrawal of the rejection and allowance of the claims.

Responsive to the rejection of claims 21, 23 and 35-41 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,298,780 (Harada) in view  
20 of U.S. Patent No. 5,877,527 (Okabe, et al), Applicants respectfully traverse.

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). Applicants submit that the cited references fail to disclose or suggest, alone or in combination, all the limitations of claim 21,  
5 and that therefore a *prima facie* case of obviousness has not been established in regard thereto.

Harada deposits a layer of conductive film 4a (*Fig. 8*) over the entire top surface of the device. That layer of conductive film completely covers the device and fills the gate trenches or grooves 40. Film 4a is then etched back (*Fig. 9*),  
10 leaving the grooves 40 completely filled with a thick conductive film 4a. (*column 5, lines 10-12, Emphasis Added*). In contrast, claim 21 recites in part "filling each of said gate trenches to a selected level substantially below the upper surface of said upper level with a conductive gate material". (*Emphasis Added*).

The method of Harada requires two steps, i.e., deposition of the  
15 conductive film and etching the film. In contrast, the method of the present invention requires one step - i.e., filling the gate trenches to a selected level substantially below the upper surface of the upper level with a conductive gate material. Applicants submit that the method of depositing a layer of conductive film that entirely covers a device and completely fills a gate trench thereof and  
20 removing (etching) that film from the top surface of the device and yet leaving the gate trench completely filled with the film does not read on a method of filling a

gate trench to a selected level that is substantially below the top or upper surface of the device.

Thus, Harada fails to disclose or suggest, alone or in combination with Okabe, et al., filling a gate trench to a selected level that is substantially below  
5 the upper surface of the upper level with a conductive gate material, as recited in part by claim 21. Since cited references fail to disclose or suggest, alone or in combination, this limitation of claim 21, a *prima facie* case of obviousness has not been established in regard thereto.

Claim 21 also recites in part "removing said trench mask from the upper  
10 surface of said upper layer without removing the layer of dielectric material covering said sidewalls of said trenches". (*Emphasis Added*). Applicants submit that such a limitation is not disclosed or suggested by the cited references, alone or in combination, that therefore a *prima facie* case of obviousness has not been established in regard thereto.

15 Harada explicitly teaches that the oxide films 4b and parts of the oxide films 13 in contact therewith are removed in order to expose the upper portions of the gate trench/grooves 40 (or recesses 41). (*Fig. 11, column 5, lines 20-23, Emphasis Added*). Thus, Harada purposefully removes the dielectric material from the upper portions of the groove/trench sidewalls in order to expose the  
20 sidewalls of the trenches, which enables source regions to be formed by diffusion of dopants from oxide which is formed in the trench after the dielectric material is

removed from the upper portions of the groove/trench sidewalls. (see Fig. 12, column 5, lines 34-37). Harada does not remove the oxide without removing at least a portion of the gate dielectric material from the sidewalls.

The Examiner asserts that the dielectric layer 13 in Figure 12 of Harada  
5 that partially covers the sidewalls of the trench reads on claim 21. Applicants respectfully disagree. Claim 21 requires that the trench mask be removed without removing the layer of dielectric material covering the trench sidewalls. Harada purposefully removes a portion of the dielectric material covering the trench sidewalls, and thus is in direct contradiction to claim 21.

10 Thus, Harada fails to disclose or suggest, alone or in combination with Okabe, et al., removing the trench mask from the upper surface of the upper layer without removing the layer of dielectric material covering the sidewalls of the trenches, as recited in part by claim 21. Since cited references fail to disclose or suggest, alone or in combination, this limitation of claim 21, a *prima*  
15 *facie* case of obviousness has not been established in regard thereto.

Claim 21 also recites in part "forming . . . source regions . . . extending to a selected depth. . . [that] is substantially coplanar with the level of the  
conductive gate material in the trench". (*Emphasis Added*). Applicants submit  
20 or in combination, and that therefore a *prima facie* case of obviousness has not been established in regard thereto.

The source regions of Harada extend to a level substantially below the level of conductive gate material within the gate grooves. The third semiconductor layer (i.e., the source) is at least longer than the first region (i.e., the upper portion of the trench that is not lined with gate dielectric) in the direction of the thickness of the second semiconductor layer. (see, column 3, lines 1-15 (*Emphasis Added*) and e.g., Fig. 12). Thus, Harada teaches that the source regions extend to a depth that is beyond or below the level of the gate electrode in the trench. The source regions of Harada, therefore, are not coplanar with the top of the conductive gate material.

Thus, Harada fails to disclose or suggest forming a plurality of heavily doped source regions that extend to a selected depth that is substantially coplanar with the level of the conductive gate material in the trench, as recited in part by claim 21. Since the cited references fail to disclose or suggest, alone or in combination, this limitation of claim 21, a *prima facie* case of obviousness has not been established in regard thereto.

Further responsive to the rejection of claim 21 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,298,780 (Harada) in view of U.S. Patent No. 5,877,527 (Okabe, et al), Applicants respectfully submit there is no motivation to make the combination proposed by the Examiner, and that therefore a *prima facie* case of obviousness has not been established in regard to claim 21.



A *prima facie* case of obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some suggestion or motivation to do so found in the references. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). However, where a proposed modification (or combination) would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). Thus, where a proposed a proposed modification renders the prior art invention being modified unsatisfactory for its intended purpose, a *prima facie* case of obviousness has not been established.

Harada discloses the diffusion process produces sources having a region of uniform distribution of impurity concentration in the vertical direction along the vicinity of the groove (*regions 5a, Fig. 1*), and which decreases in a direction away from the grooves. (*column 5, lines 43-50*). Such a distribution of dopant concentration ensures low resistance to current flow, and achieves size reduction and high integration. (*see column 3, lines 27-40*). Thus, the intended purpose of the device/method of Harada is to reduce resistance to current flow in the sources proximate the sides of the trench, and to increase resistance to current flow within the sources in a direction away from the sides of the trenches.

The Examiner proposes using the source region ion implantation method of Okabe, et al., in the method of Harada. The composite device resulting from this proposed combination has source regions formed by ion implantation. As is well known in the art, source regions formed by ion implantation have a dopant concentration that varies with depth below the upper surface of the device (i.e.,  
5 along the sides of the trenches and in the direction of current flow) and a dopant concentration that is substantially constant in the lateral plane or direction.

The composite device formed by the combination proposed by the Examiner achieves neither a reduced resistance to current flow in the sources along the sides of the trench nor an increased resistance to current flow within  
10 the sources in a direction away from the sides of the trenches. Thus, the composite device formed by the combination proposed by the Examiner achieves neither of the intended purposes of the Harada device being modified. The Harada device modified according to the proposed combination is therefore  
15 unsuited for its intended purposes.

Since the combination proposed by the Examiner renders the modified Harada device/method unsatisfactory for its intended purpose, a *prima facie* case of obviousness has not been established. Accordingly, Applicants respectfully request withdrawal of the rejection and allowance of claim 21.

20 For all the foregoing reasons, Applicants submit that a *prima facie* case of obviousness has not been established in regard to claim 21. Accordingly,

Applicants submit that claim 21, and claims 22-23, 25, and 34-39 depending therefrom, are in condition for allowance, which is hereby respectfully requested.

Claim 40 and 41 were also rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,298,780 (Harada) in view of U.S. Patent No. 5,877,527 (Okabe, et al). Responsive thereto, Applicants respectfully traverse. For the same reasons given above in regard to claim 21, Applicants submit that a *prima facie* case of obviousness has not been established in regard to claim 40. Accordingly, Applicants submit that claim 40 and claim 41 depending therefrom are in condition for allowance, and respectfully request same.

Claim 22 was rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,298,780 (Harada) in view of U.S. Patent No. 5,877,527 (Okabe, et al) and further in view of U.S. Patent No. 5,578,508 (Baba, et al.). Applicants respectfully point out that claim 22 depends from claim 21, which is in condition for allowance for the reasons given hereinabove. Accordingly, claim 22 is also in condition for allowance, which is hereby respectfully requested.

Claim 25 was rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,298,780 (Harada) in view of U.S. Patent No. 5,877,527 (Okabe, et al) and further in view of U.S. Patent No. 5,714,781 (Yamamoto, et al.). Applicants respectfully point out that claim 25 depends from claim 21, which is in condition for allowance for the reasons given hereinabove. Accordingly,

claim 25 is also in condition for allowance, which is hereby respectfully requested.

Claim 34 was rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,298,780 (Harada) in view of U.S. Patent No. 5,877,527 (Okabe, et al) and further in view of U.S. Patent No. 5,323,040 (Baliga). Applicants respectfully point out that claim 34 depends from claim 21, which is in condition for allowance for the reasons given hereinabove. Accordingly, claim 34 is also in condition for allowance, which is hereby respectfully requested.

Claim 42 has been added hereby to further protect the patentable subject matter of Applicants invention. Claim 42 recites in part "removing said trench mask from the upper surface of said upper layer without removing said portion of said gate dielectric material covering said sidewalls from said selected level to proximate said upper surface of said upper layer." (*Emphasis Added*). Claim 42 makes clear that the layer of gate dielectric above the gate conductor is not removed. Applicants submit that the cited references do not teach, disclose or suggest such a limitation, and that therefore claim 42 is in condition for allowance.

For all the foregoing reasons, Applicants submit that the pending claims are definite and do particularly point out and distinctly claim that which Applicants regard as the invention. Further, Applicants submit no combination of the cited references disclose or suggest the subject matter of the pending claims. The

pending claims are therefore in allowable form and in condition for allowance.

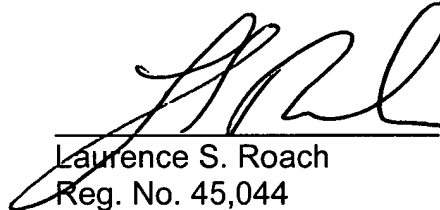
Accordingly, Applicants respectfully request withdrawal of all objections and rejections, and allowance of the claims.

In the event that Applicants have overlooked the need for an extension of  
5 time, an additional extension of time, payment of a fee, or additional payment of  
a fee, Applicant hereby conditionally petitions therefor.

The Examiner is invited to telephone the undersigned in regard to this  
Amendment and the above identified application.

Respectfully submitted,

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Date

  
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